J. Field Ornithol. 74(1):12–16, 2003

The use of nest departure calls for surveying Swamp Sparrows

Russell Greenberg[1]

Smithsonian Migratory Bird Center, National Zoological Park, Washington, D.C. 20008 USA

Received 27 March 2001; accepted 4 February 2002

ABSTRACT. Female Swamp Sparrows (*Melospiza georgiana*) give a loud series of chips as they leave their nest during incubation and brooding. I tested the efficacy of basing breeding population surveys on the nest departure call (NDC). For a subset of point-count surveys designed to estimate the abundance and distribution of Swamp Sparrows in the coastal mid-Atlantic States, I surveyed singing males and (in a longer survey) the number of different females uttering NDCs. A set of 31 points was surveyed in early June and a subset of 21 in early July. The number of NDCs was well correlated with the number of singing males detected in the early season. The number of females giving NDCs was consistently smaller than the number of singing males. In part, this is because the detection distance for NDC is significantly shorter than for male song. However, even within a small fixed circular plot, more males were detected. Singing-male surveys provide more data over a shorter period of time and are appropriate for large-scale surveys. However, female NDCs provide an index of actual reproductive activity with no unmated birds included. Although a longer survey period is required, the surveys can be conducted throughout the day. It is suggested that female vocalizations related to nesting activity are more widespread than is generally appreciated and, when possible, should be used at least as complementary data to singing-male surveys.

SINOPSIS. **El uso de llamadas de salida de los nidos para monitorear *Melospiza georgiana***
Las hembras de *Melospiza georgiana* hacen una potente serie de llamadas al dejar su nido durante la incubación y la cría. Examiné la eficacia de basar muestreos de las poblaciones reproductivas en estas "llamadas al salir del nido" (NDC). Hice un muestreo de los machos cantando y (en un estudio más largo) el número de diferentes hembras produciendo NDCs para una subrutina de muestreos por conteos de puntos diseñados para estimar la abundancia y distribución de *Melospiza georgiana* en la costa central del Atlántico. Se muestreó un grupo de 31 puntos a principios de junio y otro grupo de 21 a principio de julio. El número de NDC fué bien correlacionado con el total de machos cantando detectados al principio de la temporada. El número de hembras produciendo NDCs fué consistentemente menor que el número de machos cantando. Esto se debe en parte, a que la distancia en detectar los NDCs es significativamente menor que para detectar la canción de los machos. Sin embargo, aún dentro de una parcela de un diámetro fijo pequeño, se detectaron más machos. Los muestreos de machos proveen más datos sobre un período más corto de tiempo y son apropiados para muestreos a larga escala. Sin embargo, los NDCs de las hembras proveen un índice de la actividad reproductiva actual sin incluír aves sin pareja. Aunque se requiere un período de muestreo mayor, los muestreos se pueden conducir a través del día. Se sugiere que las vocalizaciones femeninas asociadas a la actividad de anidaje son más abundantes de lo que se aprecia generalmente y debían ser utilizadas por lo menos como datos complementarios a los muestreos de machos.

Key words: bird census, bird population estimates, female vocalizations, marsh birds, point counts

Most songbird surveys rely extensively on the detection of singing males (Ralph et al. 1995; Petit et al. 1995). Song represents the most easily detected long-distance signal given by many bird species, and in socially monogamous species it is often assumed that the abundance of singing males reflects the overall abundance of breeding females as well. However, those questioning the latter assumption (Rappole 1995) have criticized the reliance on male song for point-count and spot-mapping surveys. A number of factors complicate the relationship between singing males and the abundance of nesting birds, a population parameter that is probably the better measure of habitat suitability and local effective population size. For example, the frequency and persistence of male singing varies in complex ways diurnally and seasonally, as well as with changes in weather and stage of the nesting cycle. Furthermore, unmated males are known to sing and often sing more persistently than mated males. To add to the complexity, the percentage reduction in singing intensity after

[1] Email: antbird@erols.com

mating varies between species, population densities, and individuals within a population.

Unfortunately, alternative parameters for bird surveys, such as the location of tagged individuals of both sexes and their nests, are usually so labor intensive that they do not lend themselves to surveys that cover more than a few study plots. However, in some species of birds, well-defined calls given by females leaving active nests (Nest Departure Calls or NDCs; McDonald and Greenberg 1991) provide an alternative signal to be used to estimate the abundance of nesting birds. Furthermore, other calls associated with various phases of the nesting cycle are known for many other bird species (Ralph et al. 1993). This opens the possibility of using female vocalizations in bird monitoring programs, either as a way of assessing the validity of data gathered on singing males or as a complementary data set.

Female Swamp Sparrows (*Melospiza georgiana*) give a loud and distinctive NDC (McDonald and Greenberg 1991). The call consists of a staccato series of chips that is given obligatorily upon departure (unless the bird is flushed off the nest) regardless of nesting habitat, and less commonly upon arrival. NDCs are given regularly during nest building, incubation, and through the first five days of the nestling period (when brooding occurs), which totals approximately 21 of the 29 days of the nesting cycle (Mowbray 1997). The call is heard every 10–25 minutes at nests during incubation and brooding, values that correspond to cycles of nest attentiveness in this species (Mowbray 1997). In the course of conducting a survey of the distribution and abundance of the poorly known Coastal Plain subspecies (*M. g. nigrescens*) during the period May–July 2000, I studied the feasibility of using NDCs to survey this species. In a subset of 31 point surveys (of a survey with over 600 points for singing males), I compared the abundance estimates from singing males and calling females. In this note, I present the data and the relationship of the data between these surveys and briefly discuss the advantages and disadvantages of the two methods.

METHODS

Surveys were conducted in the coastal marshes of the Delaware Bay from Taylor Bridge, New Castle County (39°26′N, 75°36′W) to South Bower's Beach, Kent County (39°03′N, 75°24′W), Delaware. The survey sites were all tidal marshes covered with reeds (*Phragmites australis*), marsh grasses (*Spartina* spp.), and shrubs (primarily *Iva frusctescens* and *Bacharris* sp.). Survey points were selected by systematically locating points along secondary roads through marshland at 400-m intervals. The surveys were part of a large inventory program designed to develop a more complete picture of the distribution of the Coastal Plain Swamp Sparrow. Approximately half of the 67 points I surveyed for singing males were resurveyed later the same day for NDCs. Male surveys were 10 min in duration and conducted from 05:30 to 09:30, and female surveys were 45 min in duration and completed between 09:30 and 13:30. For both surveys, the distance between the vocalizing bird and observer was estimated. To determine if extending the survey time increased the number of individuals detected, I recorded the number of new males detected after 5 min and the number of new females added every 15 minutes.

Surveys were conducted twice during the breeding season: early (26 May–13 June) and late (27 June–11 July). During the late period, I surveyed only 21 of the original 31 points done in the early period. In addition, I did not repeat the early-morning surveys and instead counted singing males during the female nest-departure survey. Singing in Swamp Sparrows persists through the morning, and therefore, the counting of singing males later in the morning should not drastically effect the estimates of singing males.

RESULTS

Overall, I found about half as many calling females as singing males. For the 31 early-season surveys, I detected 0.96 (±0.16 SE) singing males within 100 meters of the sampling point and 0.58 (±0.14) females within the same distance, rendering a ratio of 0.59 females/male. For the unlimited-distance data, I found 2.48 (±0.25) males and 1.09 (±0.23) females for a ratio of 0.44. For the 21 late-season surveys, I found a total of 0.95 males and 0.42 females within 100 m (females:males = 0.44) and 2.04 males versus 0.67 females in the unlimited (females:males = 0.32).

The smaller ratio of females to males in the unlimited-distance data is related to the difference in estimated distance of detectability. The distributions of estimated distances for song and call ($N = 79$ and 32, respectively) were not significantly different from normal (based on a Kolmogorov-Smirnov test). However, singing males were detected at an average of 136 m (±8.4 SE) versus 89 m (±8.5 SE) for nest departure calls (Student's *t*-test with separate variance estimates, $t = 3.02$, $P = 0.003$). The corresponding median values were 120 m and 95 m. The distance that 95% of the birds were detected was 300 m for song and 150 m for nest departure calls.

The number of calling females is significantly correlated with the number of singing males detected at all levels of analysis. The results are similar for 100 m and unlimited detection radii, so I present only the former. Early in the season the correlation between the number of males and females detected within 100 m was moderately high (Fig. 1, $r = 0.74$, $N = 31$, $P < 0.01$), and the regression between the two variables explains 55% of the variance. The relationship between the number of males detected early in the season and the number of nest departure calls during the late season was low ($r = 0.11$, $P > 0.20$). The correlation between the number of males and females detected during the second-period sampling was moderate ($r = 0.67$, $P < 0.01$), and the correlation between the number of males detected early in the season and the number of females summed for both sampling periods was moderately high as well ($r = 0.68$, $P < 0.01$).

I found a 40% increase in females detected between 15 and 30 min over the initial 15 min and only a 3% increase in males detected after the initial 5 min. However, no new females giving NDCs were detected by extending the period from 30 to 45 min.

DISCUSSION

At a minimum, the resulting correlation between singing males detected early in the season and calling females provides support for the use of singing-male surveys as an index of the relative abundance of nesting birds. The lack of a correlation between females detected late in the season and males detected at the same points early in the season needs further exploration. However, the correlation between males detected in the two seasons was also low, and this speaks to the need to conduct surveys at several points in the breeding season.

The correlation between total females detected giving NDCs and the number of singing males during the early peak of singing was not a perfect one with only slightly more than half of the total variance in one measure explained by the other. The question arises, which type of vocalization provides a better index for population surveys? There are specific advantages and disadvantages of male versus female vocalization-based surveys (Table 1). The major disadvantages of using the nest departure call is that the survey circle needs to be small (probably no greater than 100 m) and the length of the survey long (30 min were required to detect all birds). Therefore, where maximum geographic coverage is necessary over a short period of time, singing-male surveys remain the better option. Obviously female calling reflects actual nesting activity, and thus, it is probably a more useful index to use when assessing habitat use and conservation issues pertaining to the number of breeding individuals. Furthermore, the female call is given consistently throughout the day, regardless of conditions, and there is relatively little ambiguity about the number of different birds giving the call in one area.

Based on the results of the study I recommend that a smaller number of NDC points be done at sites where singing-male surveys have been conducted to evaluate the relationship between singing-male density and active nest density. For point counts focused on discrete study plots, or for spot-mapping surveys, nest departure call remains a practical alternative to determining the density of nesting pairs, particularly where the males are not color banded. The number of females with active nests does not provide information on reproductive success, but within the context of bird survey work, it provides more information on true breeding activity than singing-male surveys alone.

This approach may seem specialized, considering the few species that have documented NDCs. However, in many other species females (or males) give distinctive calls in the presence of a nest (e.g., Ralph et al. 1993). Although

Table 1. Advantages and disadvantages of surveys based on female nest departure calls and male song.

Survey type	Nest departure call	Male song
Detectability	The sound of the call does not carry as well, and thus the sample of detections per point is smaller.	Song carries well over long distances.
Frequency	Call frequency is relatively predictable. However, the survey time needs to be substantially longer (5 min for male, 30 min for female). Even with longer survey periods, the probability of missing a vocalizing bird is much greater.	Songs are often repeated frequently. However, the frequency of singing varies unpredictably with environmental factors and the mating status of the individual.
Coverage	Surveys need to be long and the sample size is small, requiring more points. Therefore, large-scale surveys are inefficient. (However, surveys can be conducted all day).	Surveys can be short and sample sizes are often large, so more area can be covered efficiently.
Biological significance	The vocalization is directly tied to the actual presence of an active nest and therefore does not include unmated birds.	Indicates only the presence of males attempting to maintain a territories.
Temporal stability	The call is only given for about half of the nesting cycle, but within that, it is given predictably.	Given over the entire nesting cycle, but varies with period of nesting cycle.
Diurnal stability	The calls are consistently given throughout the day	Given more in morning under good weather conditions.
Spatial ambiguity	The calls are spatially unambiguous; that is, one female always gives the call from the same location.	Males often give songs from a number of localities, and the actual number of males detected can be difficult to discern without marked birds.

nest area vocalizations have not been systematically compiled or analyzed, the number of species that can be monitored by vocalizations directly related to reproduction may make this an important complementary technique to the traditional use of male song. Further research on female nest vocalizations is necessary to develop a general protocol. However, based on the data from Swamp Sparrows, it appears that the protocol can be similar to other point-count surveys except the survey period needs to be substantially lengthened and the surveys can be conducted throughout the day.

ACKNOWLEDGMENTS

I thank the Defenders of Wildlife, Chesapeake Wildlife Trust, Smithsonian Migratory Bird Center, Delaware Ornithological Society, Maryland Ornithological Society, the USGS, and the Abbott Fund of the Smithsonian Institution for support. I also thank S. Droege and J. Beadell for their work in developing the monitoring project as a whole. M. V. MacDonald provided valuable criticism of an earlier draft.

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